

REMARKS

This Preliminary Amendment is submitted with a Request for Continued Examination (RCE) for consideration in the first Office Action on the RCE, and is in response to the final rejection of February 27, 2006 and the Advisory Action of July 13, 2006. In the Advisory Action, the Examiner indicated that the Applicant's Amendment After Final did not place the application in condition for allowance, and therefore the Applicant's Amendment After Final was not entered.

Claims 1-3, 5-9, and 11-13 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Song et al. (U.S. Pat. No. 6,121,677) ("Song"), claims 4, 10, and 22 were rejected under 35 U.S.C. 103(a) as being unpatentable over Song et al. as applied to claims 7-9 above, an further in view of Lee (U.S. Pat. No. 4,935,645) ("Lee"), and claim 14 was rejected under 35 U.S.C. 103(a) as being unpatentable over Song as applied to claim 12 above, and further in view of Fenner et al. (U.S. Pat. No. 6,627,917) ("Fenner").

Examiner Interview

The Applicant would like to thank Examiner Alonzo Chambliss for his time in discussing the merits of this application with Michael Collins and Ann Kulprathipanja on July 25, 2006. No proposed amendments were discussed, although Examiner Chambliss suggested adding additional limitations to the claims highlighting structure not found in the prior art.

Claim Rejections – 35 U.S.C. § 103

Claims 1-3, 5-9, and 11-13 were rejected under 35 U.S.C. 103(a) as being unpatentable over Song et. al. (U.S. Pat. No. 6,121,677) ("Song"), claims 4, 10, and 22 were rejected under 35 U.S.C. 103(a) as being unpatentable over Song as applied to claims 7-9 above, and further in view of Lee (U.S. Pat. No. 4,935,645)("Lee"), and claim 14 was rejected under 35 U.S.C. 103(a) as being unpatentable over Song as applied to claim 12 above, and further in view of Fenner et. al. (U.S. Pat. No. 6,627,917)("Fenner").

In general, the present invention describes an integrated circuit wafer in which device trimming fuse circuits are positioned within integrated circuit dice such that they are adjacent to

scribe lanes that separate individual integrated circuit dice from one another. By locating pads used to provide a fuse blowing signal to the device trimming fuse circuits in the scribe lanes (as opposed to within the integrated circuit dice), significant savings in integrated circuit die area is achieved. Each device trimming fuse circuit is connected to a pair of pads by conductors extending from each device trimming fuse circuits into the scribe lane. Electrical trimming (i.e., a process by which the electrical characteristics of individual circuit dice are brought within permitted parameters) is accomplished by selectively applying a fuse blowing signal to selected device trimming fuse circuits via the conductors. Following the electrical trimming process, circuit dice are separated from one another through a process known as wafer dicing (i.e., singularization). When the integrated circuits are severed from the wafer (during the wafer dicing or singularization process), the pads located within the scribe lane are severed from the integrated circuits.

This is in contrast with the Song reference, which is not concerned with electrical trimming of integrated circuits. As shown in FIG. 4, the Song reference teaches placing test pads (20) in the scribe lanes (100), for providing testing signals to test circuits located in the integrated circuit regions (400) to determine the operability of the integrated circuit regions. Located between the test pads (20) and the test circuits are isolation devices (24), which may be a fuse device. In contrast with the device trimming fuse circuits of the present invention, the isolation devices (24) are used to reduce the likelihood that the conductive lines may short together when the scribe region is removed. In a preferred embodiment, the isolation devices (24) are fuses that can be cut by a laser beam. (Col. 2, lines 28-36). Therefore, the Song reference does not use isolation devices (24) to electrically trim individual integrated circuit dice. Furthermore, the Song references indicates that test pads 20 are not used to provide a fuse blowing signal (as stated above, in the preferred embodiment of Song fuses are cut by a laser beam), but rather, are used to provide test signals to the test circuitry located on the integrated circuit regions (400).

Independent Claim 1

Independent claim 1 has been amended to clarify the differences between independent claim 1 and the Song reference. Amended independent claim 1 now recites “*a first pad positioned in the scribe lane adjacent the integrated circuit die [and] a second pad positioned in the scribe lane*

adjacent the integrated circuit die.” Amended independent claim 1 further recites “a first conductor extending from the device trimming fuse circuit to the first pad and a second conductor extending from the device trimming fuse circuit to the second pad, wherein the *first and second conductors form a current path that provides a fuse blowing signal selectively applied between the first pad and the second pad to the device trimming fuse circuit* to electrically trim the integrated circuit die.” Therefore, amended independent claim 1 teaches a device trimming fuse circuit that is connected between a first pad and a second pad (both located in the scribe lane).

This is in contrast with the Song reference, in which isolation devices (24) are connected to a *single pad* (20) in the scribe lane (100). As shown in FIG. 4 of the Song reference, each isolation device (24) is connected between a single pad (20) located in the scribe lane and a circuit located within the integrated circuit region (400). Therefore, the Song reference does not teach a device trimming fuse circuit connected by conductors to a first pad and a second pad located in the scribe lanes.

Furthermore, the Song reference states that “in a preferred embodiment, the isolation devices are fuses that can be cut by a laser beam.” (Col. 2, lines 34-36). Therefore, the Song reference makes clear that the pad (20) connected to the isolation device (24) does not provide a fuse blowing signal to isolation device (24). Rather, pad (20) is used to provide a test signals to circuits located within integrated circuit regions 400. Therefore, the Song reference does not teach “a current path that provides a fuse blowing signal selectively applied between the first pad and the second pad to the device trimming fuse circuit to electrically trim the integrated circuit die” as required by independent claim 1.

The Applicant would also like to reiterate the definition of the term “trimming.” As defined in the specification, trimming is a process used “to bring the electrical characteristics within permitted parameters. For example, trimming can be used to adjust resistances or capacitances, to adjust transconductance values, and to correct for DC offsets produced by process variations.” (Paragraph 0003). Electrical trimming of an integrated circuit is accomplished by selectively applying a signal to fuse circuits (i.e., blowing selected fuses). (See Paragraph 0004). This is in contrast with “wafer dicing” or “singularization” in which integrated circuit dice located on a wafer are physically separated from one another (typically using a saw). In between the functional parts of

the integrated circuit dice are scribe lanes that “separate integrated circuits 12 from one another, and provide an area in which scribing occurs to separate the individual integrated circuit die 12 from wafer 10.” (Paragraph 0011).

In contrast, Song teaches the use of isolation devices 24 (i.e., fuses) for a purpose unrelated to integrated circuit device trimming. Song states, “The isolation devices 24 may be used to isolate the conductive lines 22 from one another to avoid the conductive lines 22 from shorting together when the scribe regions 100 are removed. For example, the isolation devices 24 may isolate conductive lines 22 from one another so that if cutting of the scribe region 100 causes a short between conductive lines 22, the test circuits are unaffected by the short.” (Col. 4, lines 1-8). Therefore, the isolation devices 24 in Song are used to electrically isolate conductive lines 22, which otherwise could be shorted together when the scribe region is cut. The isolation device 24 described in Song are not device trimming fuse circuits and can not be used to trim the electrical characteristics of an integrated circuit die as required by independent claim 1. Therefore, Song does not teach each and every element of independent claim 1.

With respect to the Office Action’s characterization of independent claim 1 as a “product-by-process” claim (both in the Office Action mailed on February 27, 2006 and the Advisory Action of July 13, 2006), the Applicant respectfully disagrees. Independent claim 1 is an apparatus claim directed toward an “integrated circuit wafer” as recited in the preamble. The integrated circuit wafer described by independent claim 1 is comprised of “an integrated circuit die having a device trimming fuse circuit; a first pad . . . a second pad . . . a first conductor . . . and a second conductor....” Furthermore, independent claim 1 has been amended to recite, “wherein the first and second conductors form a current path that provides a fuse blowing signal selectively applied between the first pad and the second pad to the device trimming fuse circuit to electrically trim the integrated circuit die.” The latter claim term clarifies the physical layout of the first and second pads, the first and second conductors, and the device trimming fuse circuit as well as the intended function of these elements. This claim term is not a process or step required to make the integrated circuit wafer. Rather, the integrated circuit wafer is manufactured with the capability of trimming the electrical characteristics of the individual circuit die located on the integrated circuit wafer.

Therefore, the characterization of independent claim 1 as a product-by-process claim should be withdrawn.

In the alternative, even if independent claim 1 were interpreted as a product-by-process claim, the product described by Song is fundamentally different than the product described by independent claim 1. The Song reference employs isolation devices 24 (e.g., fuses) to isolate the conductive lines 22 from one another to avoid the conductive lines 22 from shorting together when the scribe regions 100 are removed.” (Col 4, ll. 1-4). Therefore, Song teaches an integrated circuit wafer in which conductive lines 22 are electrically isolated from one another, but does not teach an integrated circuit wafer that includes integrated circuit dice that can be trimmed to bring the electrical characteristics of the integrated circuit dice within permitted parameters. Therefore, even if independent claim 1 were interpreted as a product by process claim, the product defined by Song is not an integrated circuit wafer capable of providing trimmed integrated circuits as required by independent claim 1.

Therefore, the Applicant respectfully requests that amended independent claim 1 is in condition for allowance.

Dependent claim 2

With this Preliminary Amendment, claim 2 has been canceled without prejudice, thereby rendering moot its rejection.

Dependent claims 3-6

Claims 3 and 5-6 were rejected under 35 U.S.C. 103(a) as being unpatentable over Song, and claim 4 was rejected under 35 U.S.C. 103(a) as being unpatentable over Song in view of Lee (U.S. Pat. No. 4,935,645). Claim 5 has been amended to correctly depend from claim 4 and claims 3, 4 and 6 have been amended to remain consistent with independent claim 1. Claims 3-6 depend from amended independent claim 1. As such, these claims are allowable with their independent base claim. In addition, the combinations of features recited in claims 3-6 are patentable on their own merits. See M.P.E.P. 2143.03, citing In re Fine, 5 U.S.P.Q.2d (BNA) 1596 (Fed. Cir. 1988).

In particular, claim 3 recites “wherein the first and second pads are a fuse pad and a supply pad, respectively.” As discussed with respect to independent claim 1, the Song reference only teaches a single pad (20) connected to each isolation device (24). Therefore, the Song reference does not teach both a supply pad and a fuse pad, wherein both pads are located in the scribe lane, connected to each device trimming fuse circuit.

Independent Claim 7

Claim 7 was rejected under 35 U.S.C. 103(a) as being unpatentable over Song. For the reasons discussed above with respect to independent claim 1, Song does not teach “a plurality of pads positioned in the scribe lane, wherein *each device trimming fuse circuit is connected to two of the plurality of pads positioned in the scribe lane* by conductors that create a current path that allows a fuse blowing signal to be applied to the device trimming fuse circuits to electrically trim the integrated circuit die . . .” As discussed with respect to independent claim 1, Song does not teach device trimming fuse circuits connected to two of the plurality of pads positioned in the scribe lane.

Furthermore, as discussed with respect to independent claim 1, the connection between each device trimming fuse circuit and two of the plurality of pads creates “a current path that allows a fuse blowing signal to be applied to the device trimming fuse circuits.” In contrast, the Song reference teaches that in the preferred embodiment, isolation devices (24) (i.e., fuses) are blown by laser beam. (Col. 2, lines 28-36). The conductors extending from single pad (20) to the circuit within integrated circuit regions (400) through isolation devices (24) are used to provide test signals to the test circuits. (Col. 3, lines 49-59), not fuse blowing signals. For these reasons, Song does not teach each and every element of amended independent claim 7.

For the reasons discussed with respect to independent claim 1, Applicant respectfully disagrees with the characterization of amended independent claim 7 as a product-by-process claim. The “product” being described with respect to independent claim 7 is an integrated circuit wafer as described in the preamble of claim 7. The integrated circuit wafer is comprised of a plurality of integrated circuit die separated by scribe lanes, the integrated circuit die having device trimming fuse circuits located adjacent the scribe lanes, and a plurality of pads positioned in the scribe lane. Independent claim 7 further recites “wherein each device trimming fuse circuit is connected to two of

the plurality of pads positioned in the scribe lane by conductors that create a current path that allows a fuse blowing signal to be applied to the device trimming fuse circuits to electrically trim the integrated circuit die, so that following singularization of the dice from the wafer, the pads are disconnected from the device trimming fuse circuits.” The latter claim term describes the manner in which the device trimming fuse circuits are connected to the plurality of pads, and the function performed by this configuration. This claim term does not describe a process of making an integrated circuit wafer, but rather describes the structure included in the integrated circuit wafer.

Furthermore, for the reasons discussed with respect to independent claim 1, even if independent claim 7 were interpreted as a product-by-process claim, the integrated circuit wafer described by independent claim 7 includes trimmed integrated circuit dies that are not described or taught by Song. Therefore, the final product generated by the present invention is materially different than the final product in Song.

Therefore, the Applicant respectfully requests that amended independent claim 7 is in condition for allowance.

Dependent Claims 8-11

Claims 8-9 and 11 were rejected under 35 U.S.C. 103(a) as being unpatentable over Song, and claim 10 was rejected under 35 U.S.C. 103(a) as being unpatentable over Song in view of Lee. Claims 8-11 depend from amended independent claim 7 and have been amended to remain consistent with independent claim 7. As such, these claims are allowable with their independent base claim. In addition, the combinations of features recited in claims 8-11 are patentable on their own merits, although this does not need to be specifically addressed herein since any claim depending from a patentable independent claim is also patentable. See M.P.E.P. 2143.03, citing In re Fine, 5 U.S.P.Q.2d (BNA) 1596 (Fed. Cir. 1988).

In particular, dependent claim 8 recites “wherein each device trimming fuse circuit is connected to a fuse pad and a power supply pad.” This is in contrast with the Song reference, which teaches (as shown in FIG. 4) an isolation device connected to only a single pad located in the scribe lane. Therefore, the Song reference does not teach each and every element of dependent claim 8.

Independent Claim 12

Independent claim 12 has been amended to clarify differences between independent claim 12 and the Song reference. Amended independent claim 12 now recites “a plurality of device trimming fuses positioned adjacent a die edge of the integrated circuit . . . and a plurality of conductors extending across the die edge for connecting *at least two of the plurality of pads to each of the plurality of device trimming fuses* to allow electrical trimming of the integrated circuit by selective blowing of the device trimming fuses, the conductors being severable during singularization of the integrated circuit.”

For the reasons discussed above with respect to independent claims 1 and 7, Song does not teach device trimming fuses connected to at least two of the plurality of pads located in the scribe lane. Therefore, Song does not teach each and every element of independent claim 12.

Furthermore, for the reasons discussed with respect to independent claims 1 and 7, independent claim 12 should not be interpreted as a product-by-process claim. In particular, independent claim 12 recites “a trimmable integrated circuit comprising . . . a plurality of conductors extending across the die edge for connecting at least two of the plurality of pads to each of the plurality of device trimming fuses to allow electrical trimming of the integrated circuit by selective blowing of the device trimming fuses.” This claim term does not describe a process or method of manufacturing a trimmable integrated circuit. Instead, this claim term recites connections between structural elements and the functional capabilities of the elements.

As discussed above, even assuming that independent claim 12 were interpreted as a product-by-process claim, the final product described by independent claim 12 is materially different than the final product defined by Song. Independent claim 12 recites a trimmable integrated circuit. In contrast, the integrated circuit taught by Song is not a trimmable integrated circuit, since Song does not provide for electrical trimming of integrated circuit dies.

Therefore, the Applicant respectfully requests that amended independent claim 12 is in condition for allowance.

Dependent claims 13 and 14

Claims 13 was rejected under 35 U.S.C. 103(a) as being unpatentable over Song, and claim 14 was rejected under 35 U.S.C. 103(a) as being unpatentable over Song in view of Fenner et. al. (U.S. Pat. No. 6,627,917). Claims 13-14 depend from amended independent claim 12. As such, these claims are allowable with their independent base claim. In addition, the combinations of features recited in claims 13-14 are patentable on their own merits, although this does not need to be specifically addressed herein since any claim depending from a patentable independent claim is also patentable. See M.P.E.P. 2143.03, citing In re Fine, 5 U.S.P.Q.2d (BNA) 1596 (Fed. Cir. 1988).

In particular, claim 14 recites “wherein a pair of adjacent device trimming fuses share one common pad.” An example of this configuration is shown in FIG. 1, in which a first device trimming fuse circuit (which includes circuitry 28A and fuse 22A) and a second device trimming fuse circuit (which includes circuitry 28B and fuse 22B) share supply pad 30. This is in contrast with both Fenner and Song, neither of which teach connecting a device trimming fuse to a first pad and a second pad located in the scribe lane. Fenner teaches (as shown in FIG. 1) a first set of pads 106(a-e) located at a single location on an integrated circuit wafer, wherein each pad 106(a-e) is connected to a plurality of IC pads 206(a-e) located on each of the plurality of individual dice 200 (as shown in FIGS. 2 and 3). A signal provided at pad 106a is provided to each individual integrated circuit die 200. In this way, Fenner teaches adjacent integrated circuits connected to a single pad, but does not teach adjacent device trimming fuses (located on a single integrated circuit) sharing a single pad. In contrast, independent claim 14 recites a pair of adjacent device trimming fuses (located on each individual die) sharing one common pad (located in the scribe lane). Each device trimming fuse is connected to two pads (wherein one pad is shared by an adjacent device trimming fuse circuit) that allows for selective fuse blowing signals to be applied to the device trimming fuses. Therefore, neither Fenner nor Song teaches “wherein a pair of adjacent device trimming fuse circuits share one common pad.”

Independent claim 22

Independent claim 22 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Song as applied to claims 7-9 in further view of Lee. Independent claim 22 has been amended

to recite “an integrated circuit die having a plurality of device trimming fuse circuits adjacent a die edge and conductors extending from the fuse circuits to the die edge . . . and a plurality of pads.” The integrated circuit die is trimmed by “applying a signal to a current path that includes two of the plurality of pads and a selected device trimming fuse circuit.” For the reasons discussed above with respect to independent claim 1, neither Song nor Lee teach a current path used for selectively providing a fuse blowing signal to a device trimming circuit, wherein the current path includes “two of the plurality of pads [located in the scribe lane] and a selected device trimming fuse circuit.

Because neither Song nor Lee teaches device trimming fuse circuits as required by independent claim 22, the Applicant respectfully requests that independent claim 22 is in condition for allowance.

CONCLUSION

Claims 1, 3-14 and 22 are in condition for allowance. Notice to that effect is requested.

Respectfully submitted,

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